REMARKS

EXAMINER'S REMARKS

The Applicant notes the Examiner's comments regarding the Information Disclosure Statement filed on 2/24/2003 and the amendments and remarks filed on 4/29/2003. The Applicant also notes the Examiner's comments regarding the current drawings on file. The Applicant will submit formal drawings when the application is allowed.

SPECIFICATION

The Applicant notes the Examiner's comments regarding the Information Disclosure Statement filed on 2/24/2003 and the amendments and remarks filed on 4/29/2003. The Applicant also notes the Examiner's comments regarding the current drawings on file. The Applicant will submit formal drawings when the application is allowed.

RESPONSE TO AMENDMENT

Claims 1-5, 8, 10-15, 17 and 34-43 (previous claims 8, 37-39 and 42-43 are herein canceled) are rejected under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Applicant respectfully disagrees, especially in view of amendments made herein.

Claim 42 is herein canceled.

Claim 1 is amended to remove the phrase "the structural strength of the layered material increases by at least 100%" in order to replace it with the phrase "the infiltrating layer reinforces the strength of the underlying nanoporous material by coating the surfaces containing the pores", which is supported by page 9, lines 29-30 and page 10, lines 1-4.

Claim 1 is also amended to replace "first layer" with "first polymer layer". Also, "a first additional layer" is replaced with "an additional polymer layer that is at least partially on the surface of the second layer and at least partially infiltrates the pores of the second layer." The specification clearly outlines what the phrase "an additional layer" means on pages 9 and 10.

35 USC §103

Claims 1-5, 8, 10-15, 17 and 34-43 (previous claims 8, 37-39 and 42-43 are herein canceled) are rejected under 35 USC §103(a) as being unpatentable over Chen et al. (US Patent No. 5,858,869) in view of O'Neill (US Patent No. 6,187,248). The Applicant respectfully disagrees.

Claim 1 recites: " A layered low dielectric constant nanoporous material comprising: a first polymer layer on the surface of a substrate; a second layer that comprises a nanoporous material and is on the surface of the first layer; and an additional polymer layer at least partially on the surface of the second layer and at least partially infiltrating the pores of the second layer, wherein the infiltrating layer reinforces the strength of the underlying nanoporous material by coating the surfaces containing the pores." The provision in claim 1 reciting that the structural strength of the layered material increases by at least 100% is discussed in the Detailed Description and specifically referenced in the Examples section, whereby a layered material's structural strength from a Stud Pull Test goes from 2 Kpsi to at least 4 Kpsi once the second layer is infiltrated by an additional layer.

Chen et al. (Chen) teaches a method for making multilevel electrical interconnections having a planar intermetal dielectric (IMD) with low dielectric constant k and good thermal conductivity. As the Examiner states, there is no teaching or suggestion in Chen that the dielectric material comprise pores or nanopores. There is also no teaching or suggestion in Chen that if the dielectric material did happen to contain pores that a polymer-based infiltrating layer could help reinforce the strength of the nanoporous material. Chen teaches that the layer of fluorine-doped silicon oxide (FSG) is added to the dielectric layer to a) keep the dielectric constant low, b) further reduce the RC delay time between conductive layers and c) to minimize via poisoning. Chen does not motivate one of ordinary skill in the art to consider utilizing a polymer-based infiltrating layer to infiltrate and in some cases coat a nanoporous layer that is on top of a polymer layer.

O'Neill et al. (O'Neill) teaches a process for producing a nanoporous polymer film of no greater than 10 micron thickness having a low dielectric constant value. As the Examiner points out, O'Neill does discuss in the Background Section the state of the art in porous dielectric materials, how

they had been utilized in microelectronics up to that point, and how certain embodiments had failed. For example, O'Neill states in Columns 1 and 2 that porous dielectric materials with high porosity content have consistently failed in the microelectronics industries because they were too brittle and were not easily processed or incorporated into other components. O'Neill suggests that the way to get over this hurdle is to use phase inversion with polymeric materials and solvents to produce porous dielectric materials, and then to crosslink the polymer materials to better withstand temperature variations and handling. (See Column 2, lines 53-67).

Despite all of the methods and processes that O'Neill uses to increase the strength of the porous dielectrics, the one thing that is not taught, suggested or considered is to add an infiltrating layer or an additional layer at least in part to infiltrate the nanoporous layer (whether it's the first layer, the second layer or both) to reinforce the strength of the underlying nanoporous material by coating the surfaces containing the pores, as is the case in the present application. Regardless of the Examiner's assertions on pages 4-5 of the last Office Action, O'Neill does not teach a layered material having a first polymer layer, a second nanoporous layer and an infiltrating layer that infiltrates the pores of the second nanoporous layer. O'Neill only teaches a porous layer that is strengthened from within by crosslinking – which is not an infiltrating material. There is also no motivation to one of ordinary skill in the art of dielectric materials and semiconductor processing and production to add an additional layer to the porous or nanoporous dielectric material in order to increase the structural strength of the layered material as a whole.

Furthermore, there is no combination of Chen and O'Neill that would give the claims of the present application, since there is no motivation, suggestion or teaching to produce a layered material having a first polymer layer, a second nanoporous layer and an additional polymer-based infiltrating layer. The background of the present application teaches this concept in this manner:

> "Regardless of the approach used to introduce the voids, structural problems are frequently encountered in fabricating and processing nanoporous materials. Among other things, increasing the porosity beyond a critical extent (generally about 30% in the known

> nanoporous materials) tends to cause the porous materials to be weak and in some cases to collapse in single-layer dielectric applications. Collapse can be prevented to some degree by adding crosslinking additives to the starting material that couple thermostable portions with other thermostable portions, thereby producing a more rigid single-layer dielectric network. **However, the porous material, even after cross-linking, can lose mechanical strength as the porosity increases, and the material will be unable to survive during integration of the dielectric film to a circuit. Also, the porous material, even after cross-linking, can lose mechanical strength by not having external support by additional coupled nanoporous layers.**" (Emphasis added)

This section in the background of the present application points out that no matter how one forms the pores in the dielectric material that incorporation and utilization of that porous material in a layered stack without additional structural strength support can cause failure in the layered material or component. Chen does not teach providing additional layers on the underlying dielectric layers in order to provide or increase the structural strength of the layered material and of the porous dielectric material. Chen only teaches providing additional hardmask or other processing layers that contribute to the production of the component or the component itself in some way other than to provide or increase structural strength. Therefore, it would not be obvious to combing the teachings of O'Neill with the teachings of Chen to produce the layered material of the present application, since it is clear that a key component of the present application is missing from both references – alone or in combination.

Based on these arguments, claim 1 of the present application is not obvious in view of Chen in combination with O'Neill. Furthermore, claims 2-5, 10-15, 17 and 34-36 and 40-41 are also not obvious in view of Chen in combination with O'Neill given their dependence on claim 1.

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REQUEST FOR ALLOWANCE

Claims 1-5, 10-15, 17 and 34-36 and 40-41 are pending in this application, and the Applicant respectfully requests that the Examiner reconsider all of the claims in light of the arguments presented and allow all current and pending claims.

Respectfully submitted,

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